

Search Plan and Results

Question

[What is the relationship between snacking and nutrient intake?](#)

[What is the relationship between snacking and nutrient intake? \(DGAC 2010\)](#)

Date Searched

11-17-09

Inclusion Criteria

- *Subjects/Population:* Human subjects
- *Age:* Children, men and women of all ages
- *Setting:* International
- *Health status:* Healthy and those with elevated chronic disease risk (CHD/CVD, type 2 diabetes, metabolic syndrome and obesity)
- *Nutrition related problem/Condition:* None.

Search Criteria

- *Study design preferences:* RCT or clinical controlled studies, large non-randomized observational studies, cohort, case-control studies, systematic reviews and meta-analysis
- *Size of study groups:* The sample size must equal 10 adults for each study group. For example, this would include 10 patients in the intervention group and 10 patients in the control or comparison group
- *Study dropout rate:* Less than 20%; preference for smaller dropout rates
- *Year Range:* June 2004 to November 2009
- *Authorship:* If an author is included on more than one review article or primary research article that is similar in content, the most recent review or article will be accepted and earlier versions will be rejected
- *Languages:* Limited to articles in English
- *Other:* Article must be published in peer-reviewed journal.

Exclusion Criteria

- *Subjects/Population:*
 - Animal and in vitro studies.
 - Malnourished/developing populations or disease incidence not relative to US population (e.g., malaria).
- *Setting:* Hospitalized patients.
- *Health status:* Medical treatment/therapy and diseased subjects.
- *Nutrition related problem/Condition:* All conditions.

Search Criteria

- *Size of study groups:* Sample sizes less than 10
- *Study dropout rate:* 20% or greater
- *Year range:* Prior to June 2004
- *Authorship:* Studies by same author similar in content
- *Languages:* Articles not in English
- *Other:* Abstracts or presentations and articles not peer reviewed (websites, magazine articles, Federal reports, etc.)

Search Terms: Search Vocabulary

(snack*) AND ("Nutritional Status"[majr] OR "nutritional requirements"[majr] OR "Nutritive Value"[majr] OR "nutrient adequacy" OR nutrient intake* OR "nutrient density" OR "diet quality")

(snack* OR fries OR cookies OR candies OR cakes OR desserts) AND ("Nutritional Status"[Mesh] OR "nutritional requirements"[mesh] OR "Nutritive Value"[Mesh] OR "nutrient adequacy" OR nutrient intake*)

Electronic Databases

Total hits from all electronic database searches: 300

Total articles identified to review from electronic databases: 49

Articles Identified Via Handsearch or Other Means

Three articles from hand-search (December 17, 2009).

Summary of Articles Identified to Review

Number of Primary Articles Identified: 5

Number of Review Articles Identified: 0

Total Number of Articles Identified: 7

Number of Articles Reviewed but Excluded: 44

List of Articles Included for Evidence Analysis

Kerver JM, Yang EJ, Obayashi S, Bianchi L, Song WO. [Meal and snack patterns are associated with dietary intake of energy and nutrients in US adults.](#) *J Am Diet Assoc.* 2006 Jan; 106(1): 46-53. PMID: 16390666.

Macdiarmid J, Loe J, Craig LC, Masson LF, Holmes B, McNeill G. [Meal and snacking patterns of school-aged children in Scotland.](#) *Eur J Clin Nutr.* 2009 Nov; 63(11): 1, 297-1, 304. Epub 2009 Aug 26. PMID: 19707230. Hand search (12-17-2009).

Maffeis C, Grezzani A, Perrone L, Del Giudice EM, Saggese G, Tatò L. [Could the savory taste of snacks be a further risk factor for overweight in children?](#) *J Pediatr Gastroenterol Nutr.* 2008 Apr; 46(4): 429-437. PMID: 18367957.

Ovaskainen ML, Reinivuo H, Tapanainen H, Hannila ML, Korhonen T, Pakkala H. [Snacks as an element of energy intake and food consumption.](#) *Eur J Clin Nutr.* 2006 Apr; 60(4): 494-501. PMID: 16319836. Hand search (12-17-2009).

Sebastian RS, Cleveland LE, Goldman JD. [Effect of snacking frequency on adolescents' dietary intakes and meeting national recommendations.](#) *J Adolesc Health.* 2008 May; 42(5): 503-511. Epub 2008 Feb 7. PMID: 18407046.

Stockman NK, Schenkel TC, Brown JN, Duncan AM. [Comparison of energy and nutrient intakes among meals and snacks of adolescent males.](#) *Prev Med.* 2005 Jul; 41(1): 203-210. Epub 2004 Dec 10. PMID: 15917012.

Zizza CA, Tayie FA, Lino M. [Benefits of snacking in older Americans.](#) *J Am Diet Assoc.* 2007 May; 107(5): 800-806. PMID: 17467375.

List of Excluded Articles with Reason

Excluded Articles (A–L)	Reason for Exclusion
Anderson JW, Patterson K. <u>Snack foods: comparing nutrition values of excellent choices and "junk foods".</u> <i>J Am Coll Nutr.</i> 2005 Jun; 24(3): 155-1556; discussion 156-157. PMID: 15930478.	Compared high nutrient, low energy snacks to low nutrient, high energy snacks in a very loose manner; not objective.

<p>Anderson VP, Cornwall J, Jack S, Gibson RS. Intakes from non-breastmilk foods for stunted toddlers living in poor urban villages of Phnom Penh, Cambodia, are inadequate. <i>Matern Child Nutr.</i> 2008 Apr; 4(2): 146-159. PMID: 18336647.</p>	<p>Does not answer the question; about eating practices of Cambodian infants.</p>
<p>Areekul W, Viravathana N, Aimpun P, Watthanakijthavongkul K, Khruacharoen J, Awaiwanont A, Khumtuikhua C, Silsrikul P, Nilrat P, Saksoong S, Watthanatham J, Suwannahitatorn P, Sirimaneethum P, Meeprom N, Somboonruangsri W, Pongmanee K, Rangsin R. Dietary behaviors and nutritional status of adolescents in a remote rural area of Thailand. <i>J Med Assoc Thai.</i> 2005 Nov; 88 Suppl 3: S240-S246. PMID: 16858963.</p>	<p>Does not answer the question; nutrition status in Thailand.</p>
<p>Arsenault JE, Mora-Plazas M, Forero Y, López-Arana S, Marín C, Baylin A, Villamor E. Provision of a school snack is associated with vitamin B-12 status, linear growth, and morbidity in children from Bogota, Colombia. <i>J Nutr.</i> 2009 Sep; 139(9): 1, 744-1, 750. Epub 2009 Jul 8. PMID: 19587125.</p>	<p>Potentially malnourished before snack intervention in school; not conducted in a high human development country.</p>
<p>Benton D, Jarvis M. The role of breakfast and a mid-morning snack on the ability of children to concentrate at school. <i>Physiol Behav.</i> 2007 Feb 28; 90(2-3): 382-385. Epub 2006 Oct 31. PMID: 17078979.</p>	<p>Does not answer the question; about breakfast and snacking.</p>
<p>Briefel RR, Wilson A, Gleason PM. Consumption of low-nutrient, energy-dense foods and beverages at school, home, and other locations among school lunch participants and nonparticipants. <i>J Am Diet Assoc.</i> 2009 Feb; 109(2 Suppl): S79-S90. PMID: 19166676.</p>	<p>Does not include analyses for nutrients.</p>
<p>Burke LM, Slater G, Broad EM, Haukka J, Modulon S, Hopkins WG. Eating patterns and meal frequency of elite Australian athletes. <i>Int J Sport Nutr Exerc Metab.</i> 2003 Dec; 13(4): 521-538. PMID: 14967874.</p>	<p>Does not answer the question; about eating patterns and food frequency.</p>
<p>Colapinto CK, Fitzgerald A, Taper LJ, Veugelers PJ. Children's preference for large portions: Prevalence, determinants, and consequences. <i>J Am Diet Assoc.</i> 2007 Jul; 107(7): 1, 183-1, 190. PMID: 17604749.</p>	<p>Does not answer the question; about fast food intake and snacking related to BMI.</p>
<p>Croll JK, Neumark-Sztainer D, Story M, Wall M, Perry C, Harnack L. Adolescents involved in weight-related and power team sports have better eating patterns and nutrient intakes than non-sport-involved adolescents. <i>J Am Diet Assoc.</i> 2006 May; 106(5): 709-717. PMID: 16647329.</p>	<p>Not evaluated by snacking; nutrients were not specific to snacking patterns but to team sport participation.</p>

<p>Davee AM, Blum JE, Devore RL, Beaudoin CM, Kaley LA, Leiter JL, Wigand DA. The vending and à la carte policy intervention in Maine public high schools. <i>Prev Chronic Dis.</i> 2005 Nov; 2 Spec no: A14. Epub 2005 Nov 1. PMID: 16263047.</p>	<p>Does not answer the question; snacking and overweight.</p>
<p>Delva J, O'Malley PM, Johnston LD. Availability of more-healthy and less-healthy food choices in American schools: A national study of grade, racial/ethnic, and socioeconomic differences. <i>Am J Prev Med.</i> 2007 Oct; 33(4 Suppl): S226-S239. PMID: 17884570.</p>	<p>Does not answer the question; about healthy advice available in schools.</p>
<p>Downs SM, Arnold A, Marshall D, McCargar LJ, Raine KD, Willows ND. Associations among the food environment, diet quality and weight status in Cree children in Québec. <i>Public Health Nutr.</i> 2009 Sep; 12(9): 1, 504-1, 511. Epub 2009 Jan 15. PMID: 19144239.</p>	<p>Does not answer the question; about food frequency and BMI.</p>
<p>Fox MK, Dodd AH, Wilson A, Gleason PM. Association between school food environment and practices and body mass index of US public school children. <i>J Am Diet Assoc.</i> 2009 Feb; 109(2 Suppl): S108-S117. PMID: 19166665.</p>	<p>Does not answer the question; about school food environment and BMI.</p>
<p>Garrido G, Webster AL, Chamorro M. Nutritional adequacy of different menu settings in elite Spanish adolescent soccer players. <i>Int J Sport Nutr Exerc Metab.</i> 2007 Oct; 17(5): 421-32. PMID: 18046052.</p>	<p>Does not answer the question; evaluation of two different menu settings.</p>
<p>Gonzalez W, Jones SJ, Frongillo EA. Restricting snacks in U.S. elementary schools is associated with higher frequency of fruit and vegetable consumption. <i>J Nutr.</i> 2009 Jan; 139(1): 142-144. Epub 2008 Dec 3. PMID: 19056643.</p>	<p>Does not answer the question; about restricting snacks.</p>
<p>Hallund J, Hatlöy A, Benesi I, Thilsted SH. Snacks are important for fat and vitamin intakes among rural African women: A cross-sectional study from Malawi. <i>Eur J Clin Nutr.</i> 2008 Jul; 62(7): 866-871. Epub 2007 May 30. PMID: 17538535.</p>	<p>Not high human development country; half of women were lactating.</p>
<p>Hang CM, Lin W, Yang HC, Pan WH. The relationship between snack intake and its availability of 4th to 6th graders in Taiwan. <i>Asia Pac J Clin Nutr.</i> 2007; 16 Suppl 2: 547-553. PMID: 17723994.</p>	<p>Does not answer the question; evaluation of snacks in Taiwan.</p>
<p>Harris JL, Bargh JA, Brownell KD. Priming effects of television food advertising on eating behavior. <i>Health Psychol.</i> 2009 Jul; 28(4): 404-413. PMID: 19594263.</p>	<p>Does not answer the question; about TV advertisement and food intake.</p>

Harrison K, Marske AL. Nutritional content of foods advertised during the television programs children watch most . <i>Am J Public Health</i> . 2005 Sep; 95(9): 1, 568-1, 574. PMID: 16118368.	Does not answer the question; about TV advertisement and food intake.
Husby I, Heitmann BL, O'Doherty Jensen K. Meals and snacks from the child's perspective: The contribution of qualitative methods to the development of dietary interventions . <i>Public Health Nutr</i> . 2009 Jun; 12(6): 739-747. Epub 2008 Aug 1. PMID: 18671890.	Sample size of less than 10 per group (N=9 in group one and N=8 in group two).
Huus K, Brekke HK, Ludvigsson JF, Ludvigsson J. Relationship of food frequencies as reported by parents to overweight and obesity at five years . <i>Acta Paediatr</i> . 2009 Jan; 98(1): 139-143. Epub 2008 Sep 24. PMID: 18823298.	It doesn't answer the question; about food frequency and obesity.
Karupaiah T, Chinna K, Mee LH, Mei LS, Noor MI. What's on Malaysian television? A survey on food advertising targeting children . <i>Asia Pac J Clin Nutr</i> . 2008; 17(3): 483-491. PMID: 18818170.	It doesn't answer the question; about TV viewing and food influence in Malaysia.
Klunklin S, Channoontmuang K. Snack consumption in normal and undernourished preschool children in Northeastern Thailand . <i>J Med Assoc Thai</i> . 2006 May; 89(5): 706-713. PMID: 16756059.	It doesn't answer the question; related to undernourished population.
Kresic G, Simundic B, Mandic ML, Kendel G, Zezelj SP. Daily menus can result in suboptimal nutrient intakes, especially calcium, of adolescents living in dormitories . <i>Nutr Res</i> . 2008 Mar; 28(3): 156-165. PMID: 19083403.	It doesn't answer the question; about daily menus in Croatia.
Larson NI, Neumark-Sztainer DR, Story MT, Wall MM, Harnack LJ, Eisenberg ME. Fast food intake: Longitudinal trends during the transition to young adulthood and correlates of intake . <i>J Adolesc Health</i> . 2008 Jul; 43(1): 79-86. Epub 2008 Mar 10. PMID: 18565441.	It doesn't answer the question; about fast food intake.
Lengyel CO, Whiting SJ, Zello GA. Nutrient inadequacies among elderly residents of long-term care facilities . <i>Can J Diet Pract Res</i> . 2008 Summer; 69(2): 82-88. PMID: 18538061.	It doesn't answer the question; about therapeutic diets.

Excluded Articles (M–Z)	Reason for Exclusion
Maddah M, Rashidi A, Mohammadpour B, Vafa R, Karandish M. In-school snacking, breakfast consumption, and sleeping patterns of normal and overweight Iranian high school girls: A study in urban and rural areas in Guilan, Iran . <i>J Nutr Educ Behav</i> . 2009	Does not answer the question; snacking and BMI in Iran.

Jan-Feb; 41(1): 27-31. PMID: 19161917.	
Maillot M, Darmon N, Darmon M, Lafay L, Drewnowski A. Nutrient-dense food groups have high energy costs: An econometric approach to nutrient profiling . <i>J Nutr.</i> 2007 Jul; 137(7): 1, 815-1, 820. PMID: 17585036.	Does not answer the question; about nutrient profile.
Mariscal-Arcas M, Rivas A, Velasco J, Ortega M, Caballero AM, Olea-Serrano F. Evaluation of the Mediterranean Diet Quality Index (KIDMED) in children and adolescents in Southern Spain . <i>Public Health Nutr.</i> 2009 Sep; 12(9): 1, 408-1, 412. Epub 2008 Dec 17. PMID: 19087384.	Does not answer the question; about diet quality.
Miller CK, Gabbay RA, Dillon J, Apgar J, Miller D. The effect of three snack bars on glycemic response in healthy adults . <i>J Am Diet Assoc.</i> 2006 May; 106(5): 745-748. PMID: 16647336.	Does not answer the question; about snack and glycemic response.
Moore GF, Tapper K, Murphy S, Clark R, Lynch R, Moore L. Validation of a self-completion measure of breakfast foods, snacks and fruits and vegetables consumed by 9- to 11-year-old schoolchildren . <i>Eur J Clin Nutr.</i> 2007 Mar; 61(3): 420-430. Epub 2006 Sep 20. PMID: 16988648.	Does not answer the question; validity and reliability of dietary recall questionnaires.
Muthayya S, Thomas T, Srinivasan K, Rao K, Kurpad AV, van Klinken JW, Owen G, de Bruin EA. Consumption of a mid-morning snack improves memory but not attention in school children . <i>Physiol Behav.</i> 2007 Jan 30; 90(1): 142-150. Epub 2006 Nov 1. PMID: 17081574.	Does not answer the question; mid-morning snack and attention in schools.
Nakaya Y, Okita K, Suzuki K, Moriwaki H, Kato A, Miwa Y, Shiraishi K, Okuda H, Onji M, Kanazawa H, Tsubouchi H, Kato S, Kaito M, Watanabe A, Habu D, Ito S, Ishikawa T, Kawamura N, Arakawa Y; Hepatic Nutritional Therapy (HNT) Study Group. BCAA-enriched snack improves nutritional state of cirrhosis . <i>Nutrition.</i> 2007 Feb; 23(2): 113-120. PMID: 17234504.	Does not answer the question; study of a late evening snack in a population with cirrhosis.
Novaes JF, Franceschini Sdo C, Priore SE. Mother's overweight, parents' constant limitation on the foods and frequent snack as risk factors for obesity among children in Brazil . <i>Arch Latinoam Nutr.</i> 2008 Sep; 58(3): 256-264. PMID: 19137988.	Does not answer the question of snacks and nutrient intake.

<p>Øverby NC, Margeirsdottir HD, Brunborg C, Dahl-Jørgensen K, Andersen LF; Norwegian Study Group for Childhood Diabetes. <u>Sweets, snacking habits, and skipping meals in children and adolescents on intensive insulin treatment.</u> <i>Pediatr Diabetes</i>. 2008 Aug; 9(4 Pt 2): 393-400. PMID: 18774998.</p>	<p>Population under study is on intensive insulin treatment.</p>
<p>Park SY, Paik HY, Skinner JD, Spindler AA, Park HR. <u>Nutrient intake of Korean-American, Korean, and American adolescents.</u> <i>J Am Diet Assoc</i>. 2004 Feb; 104(2): 242-245. PMID: 14760574.</p>	<p>Does not answer the question. Description of nutrient intake in Korea.</p>
<p>Phillips S, Jacobs Starkey L, Gray-Donald K. <u>Food habits of Canadians: Food sources of nutrients for the adolescent sample.</u> <i>Can J Diet Pract Res</i>. 2004 Summer; 65(2): 81-84. PMID: 15217526.</p>	<p>Does not answer the question; about nutrient intake.</p>
<p>Powell LM, Szczyplka G, Chaloupka FJ, Braunschweig CL. <u>Nutritional content of television food advertisements seen by children and adolescents in the United States.</u> <i>Pediatrics</i>. 2007 Sep; 120(3): 576-583. PMID: 17766531.</p>	<p>Does not answer the question; about nutritional content of food advertisements.</p>
<p>Skinner JD, Ziegler P, Pac S, Devaney B. <u>Meal and snack patterns of infants and toddlers.</u> <i>J Am Diet Assoc</i>. 2004 Jan; 104(1 Suppl 1): s65-S70. PMID: 14702020.</p>	<p>Does not answer the question; description of infant meal patterns.</p>
<p>Sweitzer SJ, Briley ME, Robert-Gray C. <u>Do sack lunches provided by parents meet the nutritional needs of young children who attend child care?</u> <i>J Am Diet Assoc</i>. 2009 Jan; 109(1): 141-144. PMID: 19103336.</p>	<p>Does not answer the question of snacks and nutrients.</p>
<p>Van der Horst K, Timperio A, Crawford D, Roberts R, Brug J, Oenema A. <u>The school food environment associations with adolescent soft drink and snack consumption.</u> <i>Am J Prev Med</i>. 2008 Sep; 35(3): 217-223. Epub 2008 Jul 10. PMID: 18617354.</p>	<p>It doesn't answer the question; about snack and related cognitions.</p>
<p>Wu SJ, Chang YH, Wei IL, Kao MD, Lin YC, Pan WH. <u>Intake levels and major food sources of energy and nutrients in the Taiwanese elderly.</u> <i>Asia Pac J Clin Nutr</i>. 2005; 14(3): 211-220. PMID: 16169831.</p>	<p>Does not answer the question; about dietary intake.</p>
<p>Ziegler P, Briefel R, Ponza M, Novak T, Hendricks K. <u>Nutrient intakes and food patterns of toddlers' lunches and snacks: Influence of location.</u> <i>J Am Diet Assoc</i>. 2006 Jan; 106(1 Suppl 1): S124-S134. PMID: 16376636.</p>	<p>Does not answer the question; about infants and toddlers.</p>

Ziegler P, Hanson C, Ponza M, Novak T, Hendricks K. [Feeding Infants and Toddlers Study: Meal and snack intakes of Hispanic and non-Hispanic infants and toddlers.](#) *J Am Diet Assoc.* 2006 Jan; 106(1 Suppl 1): S107-S123. PMID: 16376635.

Does not answer the question; about infants and toddlers.